The Citrus Industry

Entrance to new home of Florida Citrus Mutual, Lakeland, Florida. Photo courtesy Dan Sanborn, Lakeland.

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Vol. 32, No. 6 June, 1951

CITRUS INDUSTRY BUYER'S GUIDE

Grouped together on this page are the advertisements of several Florida business concerns who are reputable suppliers of commodities of interest and value to all factors of the great Citrus Industry of this State. Check these advertisements closely for supplies of which you may be in need . . .

Citrus Insect Control For June 1951

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The months of June and July are the best time to apply sprays for scale insect control. In 1951, scale populations have been generally at low levels during the early spring, and while there have been increases during March, April, and May, cool weather has slowed down the rate of increase. Both purple and Florida red scales are at much lower levels this spring than during the same period last year. This suggests that scale infestations will be less severe than in 1950. The type of weather during the summer will be the final determining factor in this, but at the moment growers can afford to be somewhat optimistic. Actually purple scales have increased materially during the past two months, but there have been only slight increases in most red scale infestations. Even though the scale infestations are at a comparatively low level, the summer scalicide sprays should be applied.

During the past few weeks purple mite populations have shown material increases in many groves. These increases have coincided with a decrease in the severity of six-spotted mite infestations. A small amount of mesophyll collapse and leaf drop has been observed from purple mite injury. If dry weather continues, irrigation will do much to prevent the leaf drop caused by purple mites.

Mealybug infestations have increased. This situation is particularly prevalent along the east coast. Evidence strongly indicates that the use of parathion at post-bloom time has been a major deterent in the prevention of mealybug infestations. Where mealybugs are present and control is desired at this time, parathion may be used at 1 2/3 to 2 pounds of 15 percent material per 100 gallons of spray.

Rust mite population have remained at a low level throughout the entire citrus area. However, there were indications during mid-May that rust mites were beginning to increase, and it is to be expected that they may be serious problems in many groves by mid-June. Therefore, it is of extreme importance that growers examine their groves at this time to be sure that rust mites do not get out of control. This is particularly important in view of the impending sulfur shortage. Less sulfur will be needed to combat mild infestations as compared to severe ones.

SPRAY RECOMMENDATIONS

Two spray materials are available for scale control: one is parathion and the other oil. From the seasonal standpoint, the best time to apply sprays for scale control is between the middle of June and the end of July. It is important, therefore, that growers plan to apply their scale sprays during this period. Sprays applied prior to the 15th of June are often failures because of the long interval between the time of application and the onset of cool weather during the fall of the year. It is probable that there will be oviposition periods for red scale early in June and for purple scale about the middle of June. This means that so far as June sprays are concerned, the best timing for red scale control will be from about June 10 to 20 and for purple scale from June 20 to the end of the month.

Sprays for scale control must be thorough. Both sides of all leaves must be covered. This is as important with parathion as with oil.

Oil Sprays—Oil should be used at 1.3 to 1.5 percent actual oil in an oil emulsion. Oil sprays should not be applied unless soil moisture is satisfactory. Oil sprays should not be applied to fruit that has not reached at least 1¼ to 1½ inches in diameter. Oil applied before the fruit reaches that size is apt to cause a condition known as oil blotch. See Figure 1. When six-spottted mites or pur-

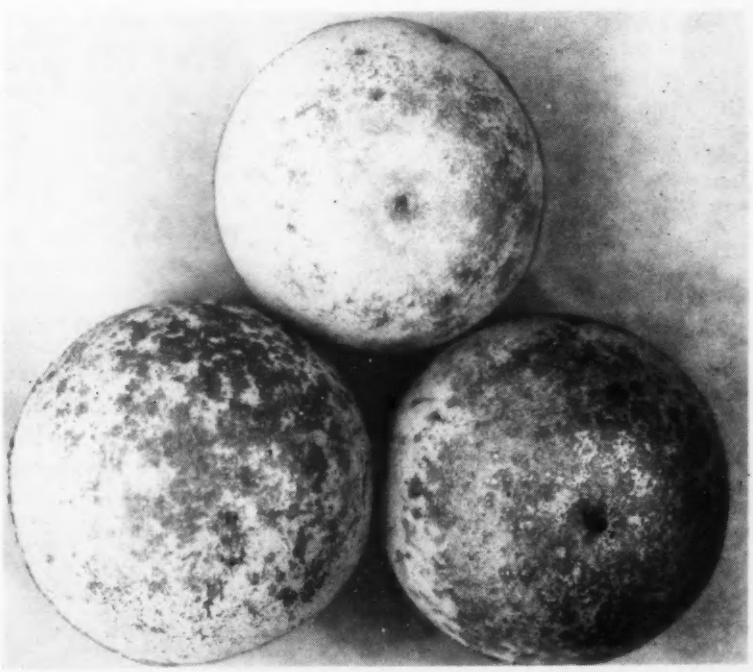

Fig. 1. — Blotching on oranges caused by spraying with oil during the time that the fruit was between ¾ and 1¼ inches in diameter.

* Written May 23, 1951. Reports of surveys by Harold Holtsberg, Cocoa; J. K. Enzor, Jr., Tavares; K. G. Townsend, Tampa; J. B. Weeks, Avon Park; and J. W. Davis, Lake Alfred.

pale mites are present, oil will control them as well as controlling scales.

Parathion Sprays — Depending upon the type of spray program, parathion may be applied at 1 pound per 100 gallons or at 1 2/3 to 2 pounds per 100 gallons of spray. The lower dosage may be used if a post-bloom parathion or copper-oil spray was used. If the summer spray will be the first for scale control, the higher amount of parathion should be used. Parathion may be applied in groves that are somewhat dry, and it can be applied without fear of fruit injury. Parathion is not a means of controlling six-spotted or purple mites, and it should not be expected to do this.

Parathion should be combined with wettable sulfur. The amount of wettable sulfur will be dependent upon the intensity of the rust mite infestation in the particular grove. Where a sulfur spray has just preceded the parathion application or where practically no rust mites are present, sulfur should be reduced to probably no more than 5 pounds per 100 gallons.

For more specific information consult the Florida Citrus Experiment Station at Lake Alfred or Fort Pierce.

USDA ISSUES GRADE STANDARDS FOR ORANGE MARMALADE:

The U. S. Department of Agriculture has announced the establishment, for the first time, of U. S. standards for grades of orange marmalade. The standards will become effective for use June 21, 1951.

The new standards include two grades—Grade A or Fancy, and Grade B or Choice. The standards provide for a "clear" and a "natural" type and for three kinds—"sweet", "bitter", and "sweet and bitter." While marmalade with peel sliced into thin strips is the most common style, the style known as "chopped" is also included in the new standards.

AN IMPORTANT NEW CITRUS FRUIT BULLETIN

An important new citrus fruit bulletin, officially known as harvesting, handling and transportation of citrus fruits, has just been issued by the United States Department of Agriculture.

Compiled by Dean H. Rose, formerly Senior Physiologist, Harold T. Cook, Senior Pathologist, and W. H. Redit, Mechanical Engineer of the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration at Beltsville, Maryland, the Bulletin contains excerpts from the findings of leaders in the industry from all parts of the world.

The information it contains, boiled down to essential features, is of value to every citrus grower and to anyone connected in any way with the industry, whether as a producer, a shipper, a canner, a concentrator or a supplier. Such citrus authorities as Batchelor, Camp, Webber, Reitz, Spencer, Watson, Berger, Quayle and others are quoted liberally.

The Bulletin is, in short, a symposium of the finding of the best minds in the industry, brought together in a comprehensive and authoritative manner.

A limited number of the Bulletins are available on application to the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 40 cents.

The Citrus Industry
EXCLUSIVE SPECIALIZED CITRUS PUBLICATION
Issued Monthly
Representative of every interest
Representing no special interest

Publication office at Bartow, Florida. Entered as second class matter February 16, 1920, at the post office at Tampa, Florida, under the act of March 3, 1879. Entered as second class matter June 19, 1933, at the post office at Bartow, Florida, under act of March 3, 1879.

The Effect Of Variable Potash Fertilizer On The Quality And Production Of Duncan Grapefruit

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AT MEETING OF FLORIDA HORTICULTURAL SOCIETY

INTRODUCTION

For many years potash has been a major constituent in the fertilizer mixtures applied to citrus in Florida. The use of potash in moderate amounts has seemed reasonable, for citrus soils in Florida are not well supplied with potassium containing minerals. There is consequently, only a minimum supply of pottasium for utilization by growing trees in Florida except as furnished in the form of fertilizer. Like nitrogen, potassim does not accumulate in these sandy soils (15) and much of that not absorbed by the roots of the trees is lost. Unlike nitrogen however, potassium deficiency symptoms are not quickly discernable under field conditions. A number of papers have been published covering one phase or another of the work on the use of potash on grapefruit at the Citrus Experiment Station and at this time it seems desirable to summarize these findings up to date. In this paper the symptoms which have been found to be associated with potassium deficiency in the field, and the effect of variable potash fertilization on the internal and external quality and on production of Duncan grapefruit are presented and related papers reviewed.

LITERATURE REVIEW

A study of the literature dealing with potassium nutrition of citrus reveals that a large number of symptoms have been associated with potassium deficiency. It should be kept in mind that in most cases these symptoms have been observed where citrus was growing under artificial conditions in pot or sand culture, and that to-date, many of these symptoms have not been observed under field conditions. The reported symptoms include dying-back of the uppermost branches of the tree with the lower branches showing little signs of deficiency (2); splitting and gumming of the twigs; scorching and excessive drop of leaves, resinous spotting, fading of the chlorophyll, and development of a bronze-yellow color (Hass 11-12-13-14). Tucking, and twisting of the leaf blades is still another symptom, (4). With the exception of results reported by Byran (2), the deficiency symptoms referred to were associated with orange varieties and not grapefruit. Whether all of these symptoms apply to grapefruit has not yet been established.

Fruit symptoms associated with potassium deficiency have also been fairly well classified, although there are some controversial reports as to the effect on the external appearance of the fruit. Byran (2) reported that in the few cases where fruits were produced on trees grown in pot culture, under deficiency conditions, the fruit did not appear to differ from fruit produced by trees which received potassium in sufficient amounts. Eckstine **et. al.** (8) have described fruit produced under potassium deficiency as being thick-skinned, coarse, and with poor color. Fruit of small size has been reported by most workers to be characteristic of fruit produced by potassium deficient trees, (1,6,13,14,19). It is generally agreed that oranges produced by trees deficient in potassium will contain a lower percent-

age of citric acid in the juice, (17, 1,19,13,14). Roy (17) has further reported that Valencia oranges not supplied with potassium produced fruit with a higher content of reducing sugar, a lower content of non-reducing sugar, and a lower pH of the juice.

Although it was believed for many years that muriate of potash was an inferior source of potassium for the fertilization of citrus, investigations by Roy (17), Cowart (7) and Bahrt and Roy (1) have shown that either potassium sulfate or chloride are satisfactory fertilizer salts. An explanation of the background concerning these sources of potassium is necessary for it emphasizes the importance of magnesium in relation to potash fertilizer practices, and to some extent the effect of magnesium on the interpretation given to some of the earlier potassium experiments. During World War I, this country was forced to depend largely on domestic sources of potassium. One of these, potassium chloride caused trouble because of the boron which it contained. Because of these experiences, combined with unsatisfactory results from using muriate on other crops, especially tobacco and potatoes, potassium chloride was held in disfavor and preference was given to sulfate as a source of potassium for citrus.

Kainite also used as a source of potassium contained appreciable amounts of magnesium as magnesium sulfate and chloride. As magnesium deficiency became more wide-spread in Florida in the late twenties and early thirties it was found that larger applications of Kainite improved the quality of fruit on these magnesium deficient groves. Large, coarse fruit is associated with magnesium deficiency and when Kainite was applied to deficient trees the fruit quality improved not because of the potassium but because of the added magnesium.

The potash source experiment started in 1924 at the Citrus Experiment Station and continued until 1942, furnishes another good example of the effect of magnesium on the interpretation of results of a potassium experiment. This experiment was initiated to ascertain the effect of muriate, sulfate and sulfate of potash and magnesia on the growth and production of citrus. After several years the sulfate of potash and magnesia appeared to be a superior source of potassium. When under the direction of Dr. A. F. Camp, magnesium sulfate was added to the muriate and sulfate of potash treatments in amounts equivalent to the magnesium contained in the sulfate of potash and magnesia treatments, the differences between the plots disappeared (7).

These examples illustrate the multiplicity of factors which are frequently involved in studying fertilizers for tree crops, some of which may not even have been considered when the experiment was initiated.

METHODS

The experiment discussed in this paper was first started in 1921, as reported by Ruprecht (18). At that time a block of Duncan grapefruit was laid out into six plots in such a manner that plots designated as 1, 3 and 5 received 3 percent, and plots 2, 4 and 6 received 10 percent potash in the fertilizer mixture. In the 1924 report, Ruprecht stated that the potash treatments for plot 5 were changed so that 3 percent potash was applied in the spring, 5 percent in the summer and 10 percent in the fall applications. During the period between 1924 and 1929 the plots were changed again so that plot 5 received 5 percent potash at each application and plot 6 received 3 percent potash in the spring, 5 percent in the summer and 10 percent in the fall applications. The plots were continued in this manner until 1936, at which time the original experiment was discontinued and the plots were turned over to Dr. A. F. Camp and his co-workers at the Citrus Experiment Station.

In the 1930 report, Ruprecht (18) had stated that the trees in the plots receiving 10 percent potash were in an unsatisfactory condition. It later developed that the cause of this condition was due to deficiencies of magnesium, copper, zinc, and manganese, with magnesium deficiency being especially acute. In order to correct this condition nutritional sprays were applied, and 4000 pounds of dolomitic limestone was applied to part of this block during 1936, 1938 and 1939, with the same potash treatments as used by Ruprecht being continued.

Beginning with the fall application in 1939, plot 6 was changed to a 0 percent potash treatment and the trees in this plot have received no potash fertilizer since that time. During the period since 1936 the trees have been on a 3 percent nitrogen program, and since 1939 have received a mixture with the formulas shown in Table 1. These mixtures are applied three times a year in February, June and October. The poundage has varied somewhat through the years. having been increased as the trees became larger. Since 1939 the poundage has varied between 15 and 20 pounds per application. Zinc is applied annually as zinc sulfate at the rate of 3 pounds per 100 gals. as a dormant spray. Except as noted, the plots all receive identical treatment in keeping with good grove management practice.

The term internal fruit quality as used in this paper refers to internal characteristics of the fruit based on soluble solids, citric acid, and ascorbic acid content of the juice. Total soluble solids were measured with a Brix hydrometer and the readings corrected to a temperature of 17.5°C. Total titratable acidity, (calculated as anhydrous citric acid) was determined by the titration of a 25 ml. aliquot juice against .3125 N sodium hydroxide solution. The ascorbic acid (vitamin C) content was determined by the method of Menaker and Guerrant (16) and reported as milligrams of ascorbic acid per 100 milliliters of juice.

RESULTS

Visual Deficiency Symptoms under Field Conditions—Under artifical conditions, it is possible to grow citrus trees which manifest deficiency symptoms of potassium rather rapidly. This is not true under field conditions because it is not possible to eliminate potassium from a soil as can be done

Table 1.
Fertilizer Program for the Plus Magnesium Plots, Block V.
1939 - To-Date.

Plot No.	Formula (Percentage)					
	N	P205	K20	Mg0	Mn0	Cu0
6	3	6	0	3	1	½
1 & 3	3	6	3	3	1	½
5	3	6	5	3	1	½
2 & 4	3	6	10	3	1	½

with a nutrient solution. The increased period of time required for deficiency symptoms to become evident in the field is due to several factors. The tree stores potassium, which apparently may be redistributed and reassimilated to such an extent, that the growth centers are not immediately affected. Also, a citrus tree appears to be relatively efficient in absorbing and utilizing potassium ions with which its root system comes into contact, (20). Still another factor is the reutilization of potassium resulting from the decomposition of dropped fruit in the grove. Where potash fertilization was withheld entierly from the trees in plot 6, beginning in 1939, no symptoms of potash deficiency developed until the spring of 1943. Following the cold period of February 15-18, 1943, it was observed that the trees in this plot suffered more cold damage than in the plots where potassium was supplied. It was also becoming evident at this time, that the trees were showing less top growth and that the leaves were smaller, bu very marked differences in tree appearance were still not evident. At about the same time, it was noted that more fruit was dropping previous to harvest where potash was withheld. This condition continued to develop and by the 1945-46 season was very evident. The trees not supplied with potash have thus far continued to bloom and set fruit, but beginning sometime in July a heavy pre-harvest drop occurs which usually continues through the harvesting season. Table 2, shows the percentage of the crop which dropped during the past two seasons. The larger number of drops listed for the 1949-50 season includes fruit which was blown from the trees during the August 27th hurricane. During the past three seasons the drops have been removed regularly from the grove and since starting this practice the trees appear to be declining more rapidly from potassium deficiency than before, indicating the potassium reserve in these trees is becoming low. It should be noted that had the experiment been discontinued before the spring of 1943, say at the end of 3 years, a flat but erroneous conclusion could have been drawn that potash fertilization was unnecessary.

Another potassium deficiency symptom which has been apparent on occasions is the tendency for the trees not supplied with potash to lose young shoots during windy periods. During the early part of March, 1950, rather high winds with light rains occurred for several days shortly after the spring flush of growth had appeared. About a week later it was observed that a number of young shoots 3 to 15 inches in length had been blown from the trees and were lying on the ground. The number of shoots blown off in each of the potash plots is recorded in Table 3. The break always occurred at the point of emergence of the shoot from the stem or branch.

Table 2. The Effect of Variable Potash Fertilization on the Pre-harvest Drop of Duncan Grapefruit.

Fertilizer Treatment								Percentage of Dropped Fruit*	
N	—	P_2O_5	—	K_2O	—	MgO—MnO—CuO		1948-49	1949-50
3	—	6	—	0	—	3 — 1 — ½		45.7	82.5
3	—	6	—	3	—	3 — 1 — ½		37.3	67.2
3	—	6	—	5	—	3 — 1 — ½		29.5	68.5
3	—	6	—	10	—	3 — 1 — ½		29.5	62.9

* Values represent percentage of total number of fruits. Drop counts were made from September 23 through Dec. 3, 1948 and from August 31 through Nov. 25, 1949.

At the present time there are no distinct observable differences in tree condition between the trees which are receiving the 3, 5, and 10 percent potash applications, but there is a sharp contrast between the potash fertilized trees and those which receive no potash fertilizer. Trees in the latter plot are decreasing in size, the tops are thin and the leaf size now appears small on a number of trees. Leaf symptoms denoting potassium deficiency are not obvious. Some twisting and tucking of the leaves of a few trees have been noted on occasion.

Internal Fruit Quality.—Sampling and analyses of the fruit produced by the trees in the potash plots has been continued regularly since 1939. A considerable amount of data relative to fruit quality has been obtained, but only data for the past three years covering soluble solids, percent citric acid, solids/acid ratio and the vitamin C content is being presented at this time. This is representative of the data as a group and shows the differences in these juice characteristics as influenced by the potash treatments which the trees have received.

Contary to results reported by Roy (17) and Bahrt and Roy (1) in their study of Valencia oranges, the soluble solids content of the juice of Duncan grapefruit from potassium deficient trees is significantly lower in most cases than where potassium is supplied. Variations in the rate of potash application between 3 and 10 percent in most cases caused no significant difference in the soluble solids content of the juice (Table (4). The percentage of titratable acid is consistently and very sharply reduced where potash is limiting, and is increased significantly with increasing applications of potash up to 10 percent in the fertilizer mixture.

In as much as the ratio, (soluble solids/acid) of grapefruit juice is usually the factor determining earliness of maturity for grapefruit, the effect of potash applications on the ratio is of particular interest. The ratio of soluble solids to acid is increased where potash is limiting, and is decreased significantly with increasing applications of potash. The decrease in the ratio where the potash application has varied between 5 and 10 percent has been significant some seasons and not in others, Table 4. In general; however, the trend has been for the ratio of the juice to continue to decrease with application of potash up to 10 percent in the fertilizer mixture. The differences in the time of passing legal maturity as influenced by these fertilizer treatments for the past two seasons are presented in Table 5.

The effect of potassium deficiency and variable potash application on the vitamin C content of the juice,

Table 3. Loss of New Shoots as Affected by Variable Potash Fertilization

Fertilizer Treatment								Average Number of Shoots Lost per Tree
N	—	P_2O_5	—	K_2O	—	MgO—MnO—CuO		182.8
3	—	6	—	0	—	3 — 1 — ½		
3	—	6	—	3	—	3 — 1 — ½		11.3
3	—	6	—	5	—	3 — 1 — ½		19.3
3	—	6	—	10	—	3 — 1 — ½		10.7

Table 4.
The Effect of Variable Potash Fertilization on the Internal Quality of Duncan Grapefruit.*

Fertilizer Treatment							Percent Soluble Solids			Percent Citric Acid			Solids / Acid			Ratio			Vitamin C		
							1947-48	48-49	49-50	47-48	48-49	49-50	47-48	48-49	49-50	47-48	48-49	49-50	47-48	48-49	49-50
N	P_2O_5	K_2O	MgO	MnO	CuO																
3	6	0	3	1	½		8.64	9.04	9.50	1.12	1.07	1.29	7.77	8.52	7.35	36.1	36.9	35.9			
3	6	3	3	1	½		9.19	9.67	9.76	1.29	1.30	1.45	7.12	7.48	6.77	40.8	37.9	40.4			
3	6	5	3	1	½		9.11	9.55	9.80	1.40	1.32	1.59	6.56	7.12	6.20	41.1	39.2	40.6			
3	6	10	3	1	½		9.24	10.06	10.05	1.40	1.48	1.61	6.61	6.82	6.24	41.8	41.1	43.4			
L.D.N.S		(1% level					0.380	0.316	0.998	0.091	0.099	0.149	0.397	0.442	0.453	3.107	2.142	3.714			
		(5% level					0.281	0.227	0.702	0.067	0.071	0.105	0.293	0.317	0.318	2.293	1.536	2.61			

* Values given are seasonal average values and represent the mean of all of the samples taken throughout each season. Sampling was usually started in September and continued until February or March of each year at intervals of two to three weeks.

follows a pattern very similar to that discussed for soluble solids. Where potassium is limited, the vitamin C content of the juice is significantly decreased. Variation in the application of potash from 3 through 10 percent has resulted in slight increases in the vitamin C content at the higher applications but the differences are slight

External Quality. — The conclusions drawn by Eckstein, Bruno and Turrentine (8) that potash deficiency is manifested by the production of large, coarse fruit are apparently incorrect. The reports of investigators working with oranges, and a previous study by the author (19) show clearly that small fruit, with thin rind, and good texture, are produced where potash is limited. There has been no consistent difference in the proportion of Duncan grapefruit meeting the several standard U. S. Grades, due to potassium deficiency, or to variations in the level of potash fertilization. Early in the season there appears to be a rather large differential in size of fruit produced between trees which receive no potash fertilization and those which do. As the season progresses this is less apparent, probably due to the increased number of drops and the smaller number of fruit left on the deficient trees. During the past five years the fruit from the trees not supplied with potash has averaged about 0.10 inches smaller in diameter than fruit from trees supplied with potash. This is slightly less than the difference in average diameter between one commercial size. During the entire period the fruit from these plots has always been held late into the season, which probably accounts for the differential in size not being greater. No consistent differences in size of fruit produced has been found to-date where potash has been applied, even though the N/K_2O ratio has varied from 1-1 to 1-3.3.

Production. — Table 6, presents a summary of the production of fruit as affected by variations in the level of potash fartilization during the period from 1940-41 through 1949-50. These data, based on the average production for the past nine years, show that the trees receiving 5 percent potash fertilization have yielded significantly more fruit than the trees receiving the other treatments. The difference between the production of these trees, and those to which 3 percent potash is applied, is of greater interest when tree condition as affected by previous treatment is considered. The reports by Ruprecht frequently indicated that trees receiving the 3 percent potash treatment were producing the most fruit during the period from 1921 until 1936, with the exception of one year, 1934. Further, Camp (3) reported that the 3 percent trees were affected the least by magnesium deficiency at the time that the original experiment was stopped, and corrected, in 1936. Based on previous performance, the highest production should be from the trees supplied with 3 percent potash. The indications are that 3 percent potash, which is equivalent to 1:1 nitrogen-potash ratio at the rate of application used, has not been sufficient to maintain production as compared to the higher 1:1.6 ratio which corresponds to the 5 percent treatment. Statistically there is no significant difference in the production of fruit from trees receiving the 0 percent, 3 percent or the 10 percent potash treatment as ascertained by the nine year average. It is evident from the data, however, that the production of the trees receiving no potash has fallen off badly since the 1946-47 season, the average yield per tree since that time being only 295 pounds. The nine year average value for the trees not supplied with potash is comparatively high by virtue of the fact that these trees were producing heavily during the early part of the experiment.

DISCUSSION

Under the present maturity law in Florida, earliness of maturity for grapefruit, once the juice content requirements are met, is determined in most cases by the solids to acid ratio of the juice. Reported earliness of maturity of grapefruit as affected by a low nitrogen to potash ratio (19), together with similar results having been reported for oranges has resulted in a more wide-spread use of lower nitrogen-potash ratios in fertilizer mixtures. Ruprecht reported in 1936 that based on the results of the potash rate experiment at that time that there appeared to be no advantage in using a ratio of nitrogen to potash higher than 1:1. The fact that production appears to be falling off in the plots which are receiving this treatment and that the number of drops is usually higher than in either the 5 or 10 percent plots would seem to indicate that this ratio may be too narrow to obtain maximum yields at the rate of application used in this experiment.

Table 5. Estimated Dates of Passing Legal Maturity Standards as Affected by Various Potash Fertilization Treatments.

Treatment							1948-49			1949-50		
N	P_2O_4	K_2O	MgO	MnO	CuO		Estimated Date		Difference in Days	Estimated Date		Difference in Days
3	6	0	3	1	½		September 10			October 15		
3	6	3	3	1	½		October 2		22	December 10		56
3	6	5	3	1	½		October 15		35	January 3		80
3	6	10	3	1	½		October 18		38	January 6		83

It should be emphasized that it has not been possible under the conditions of this experiment to see immediate effects from changes in potash fertilization either as related to tree condition, production or fruit quality. The rather quick responses which have been evident in citrus from correcting zinc deficiency, or from applications of nitrogen have not been observed as a result of variations in the applications of potash. Thus, if the lower production which has been found in this experiment where a 1-1 nitrogen-potash ratio has been used, may be considered as indicative of what happens under field conditions generally, the production may be decreased so gradually in a commercial grove as to go unnoticed except by the most discerning growers.

The nitrogen to potash ratio in a 4-6-8-3-1-½ fertilizer mixture applied In the fall and summer applications, followed by an 8-0-8-6-2-1 spring top-dresser, is approximately a 1-1.67 ratio of nitrogen to potash and not a 1-2 as it is frequently referred to. This corresponds to the 5 percent potash application used in this experiment which has to date resulted in the highest average yields. Even where this ratio is applied, as was pointed out earlier by Fudge (10), a large percentage of the applied potassium is removed annually by the harvest crop. It is of course, a matter of conjecture as to the results which might have been obtained had the rates of application of these mixtures also been varied but this was not included in this experiment.

SUMMARY

Potassium deficiency under field conditions for Duncan grapefruit was manifested by slow growth and thinning of the tops of the trees, loss of young shoots by wind, preharvest drop of fruit and decreased production. The fruit produced was small in size, with good texture and thin rind. Internal quality was characterized by decreased soluble solids, citric acid and vitamin C content. Fruit from deficient trees matured earlier as judged by the soluble solids/citric acid ratio. The acid content of the juice increased and the ratio decreased in fruit produced by trees supplied with potash applications ranging up to 10 percent in the fertilizer mixture.

Continuous use of a 1.1 nitrogen-potash fertilizer ratio at the rate of application used in this experiment resulted in decreased yield of fruit as compared to a 1:1.67 nitrogen-potash ratio.

Table 6. The Effect of Variable Potash Fertilization on the Production of Duncan Grapefruit.*1

Fertilizer Treatment					Avg. Yearly Production—lbs./Tree					Average for First 5 Years	Avg. Yearly Production—lbs./Tree			Average for Past 4 Years	9 Year Average
N	P2O5	K2O	MgO	MnO—CuO	1940-41	41-42	42-43	43-44	44-45	45-46		46-47	47-48	48-49	49-50		
3	6	0	3	1 — ½	616	773	798	1175	——	790	830	217	561	281	121	295	594
3	6	3	3	1 — ½	259	475	421	1022	——	596	553	527	857	453	315	538	545
3	6	6	3	1 — ½	686	755	765	1289	——	1093	914	573	1073	522	417	646	797
3	6	10	3	1 — ½	311	468	599	1221	——	598	639	581	846	555	370	588	616
L.D.N.S. between treatment average for 9 year period = 224 at 1% level = 164 at 5% level																	

* No production figures are available for the 1944-45 season, the crop was lost as a result of the hurricane which occurred that year.
1 The author wishes to express thanks to Mr. H. O. Sterling, Citrus Experiment Station, who cooperated in securing the production data.

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FLORIDA FRUITS AND NUTS

Citrus took the lead again this year in the $72 million increase in value of fruits and nuts harvested. There were 3,858,500 tons of fruits and nuts harvested — 208,000 less than the year before, but higher prices boosted the total valuation from $130 million in 1948-49 to over $202 million in 1949-50. Planting of citrus continued at somewhat above the average rate, boosting the total acreage about 10,300 above last year. With this additional citrus acreage the total acreage of all fruits and nuts in the State is now estimated at 556,300 acres. Bearing acreage amounts to 495,800 acres, 11,000 above 1948-49.

Fish and shellfish are an excellent source of easily digestible protein and contain easily digested fats.

Experiments On Control Of The Citrus Red Mite

(PURPLE MITE)

HERBERT SPENCER AND
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OF ENTOMOLOGY & PLANT
QUARANTINE

Reprinted From The Florida Entomologist, Vol. XXXIV, No. 1, March, 1951

The citrus red mite,[1] or purple mite, has become an important problem in Florida in recent years. In 1950 this pest was especially prevalent and troublesome.

Experiments on control of this pest were started in 1937 and are still under way. Spencer and Osburn (1949) in 1948 summarized progress in control up to that date. Oil emulsion or emulsive-oil sprays at from ½ to 1 2/3 gallons per 100 gallons of water gave adequate control, but such applications are in addition to the regular sprays and, accordingly, are costly to growers. Moreover, they may injure the trees in cold weather or in very dry periods. Much needed was a miticide that could be added to the regular sulfur sprays. Among the newer insecticides dinitro-o-cyclohexlyhenol (DN) was effective, was compatible with wettable sulfur, and has come into use for the cooler months, but may cause injury in hot weather. Neotran, containing 40 percent of bis(p-chlorophenoxy) methane, was effective in controlling the mites, compatible with materials in regularly scheduled sprays, and safe in summer and winter. Parathion gave promise of control, but in one instance a buildup of citrus red mites followed its use.

In 1949 and 1950 a number of new miticides became available for the experiments. This paper gives results with these materials, as well as additional information on the miticides previously found promising.

In 1949 a grove of Temple trees was arranged for a comparison of control of citrus red mites with parathion plus wettable sulfur, and combination sprays of wettable sulfur and the miticides Neotran, Karathane (2-c a p r y l-4,6-dinitrophenyl crotonate, 25 percent, formerly called Arathane) and azobenzene. All the trees had been sprayed in February with a nutritional combination of zinc, manganese, and copper sulfates, hydrated lime, and wettable sulfur, and in April with a post-bloom application of basic copper sulfate plus wettable sulfur. As is usual after nutritional sprays that leave heavy residues, severe mite infestation developed. On May 27, 80 percent of the leaves showed infestation by citrus red mites (eggs or crawlers). The experimental sprays were applied May 31 and June 3. Twenty days later the infestations were as follows:

[1] Paratetranychus citri (McG.).

Spray combination (quantities per 100 gal.)	Percent of leaves infested
Oil emulsion (1 percent oil)	4
Parathion, 25% wettable, 1 lb. + wettable sulfur 6 lbs.	89
Neotran 1 lb. + wettable sulfur 6 lbs.	3
Karathane 1 lb. + wettable sulfur 6 lbs.	6
Azobenzene, 70% wettable, 1 lb. + wettable sulfur 6 lbs.	24

The oil emulsion gave satisfactory control. The Neotran plus wettable sulfur and the Karathane plus wettable sulfur gave as good control as the oil. Some reduction also resulted from the azobenzene plus wettable sulfur, but the control was not sufficient. The parathion plus wettable sulfur may have killed a few adults when applied, but at the end of 20 days the infestation was heavier than before the spraying.

In 1950 several additional materials were available, including EPN-300 (ethyl p-nitrophenyl thionobenzene phosphonate, 30 percent), Aramite or 88-R(2-(p-tert-butylphenoxy)-1-methylethyl 2-chloroethyl sulfite, 15 percent), R-242 (p-chlorophenyl phenyl sulfone, 25 percent), 923(dichlorophenyl benzenesulfonate, 50 percent emulsifiable), and K-6451 or C-854(p-chlorophenyl p-chlorobenzene sulfonate, 50 percent). The same grove was arranged in randomized blocks, with 10 replications of single-tree plots, for comparison of eight combination sprays of basic copper sulfate, wettable sulfur, and eight miticides. The sprays were applied post-bloom on March 15-17. A prespray estimate of infestation was made on March 14 and estimates of control were made on May 10. The spray combinations and results are given in Table 1.

All the new materials gave good control of the heavy infestation. The slow-acting azobenzene was the best miticide in this tset, K-6451 was next, followed by Neotran. Aramite and 923 were the poorest, but they may show up better in future tests when used in increased amounts per 100 gallons in the sprays.

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It is estimated that there are nearly 28 million bearing trees in commercial citrus groves of Florida.

TABLE 1.—Control of Citrus Red Mites* with Combination Sprays, 1950.

Basic copper sulfate 3 lbs. plus wettable sulfur 5 lbs. per 100 gals. plus—	Percent of leaves infested	
	Prespray May 14	After spraying May 10
No miticide (checks)	42	71
Neotran 1 lb.	39	19
Karathane 1 lb.	36	23
Azobenzene, 70% wettable, 1 lb.	53	9
EPN-300 ½ lb.	43	23
Aramite 2 lbs.	37	42
R-242 4 lbs.	42	27
923, 1 pt.	52	37
K-6451, 1 lb.	37	17

* Crawling adults, young stages, or unhatched eggs.

Research Workers Hold Conference

Members of the citrus industry and research workers who have contributed to the rapid expansion of citrus processing during recent years, especially in the field of concentrates, took stock of developments at a conference in Winter Haven, Fla., May 9.

The conference, arranged by the U. S. Department of Agriculture in cooperation with advisory groups, brought together many of the nation's leading scientists, growers, and processors to consider jointly the utilization of citrus crops. About 150 persons attended, with all citrus areas represented.

Dr. M. K. Veldhuis, in charge of the U. S. Citrus Products Station, was official host. Representatives of other USDA field stations, State Experiment Stations, industries, and others engaged in citrus processing research participated actively. Dr. Roy Magruder of the Agricultural Research Administration and Dr. Harry W. von Loesecke, Bureau of Agricultural and Industrial Chemistry, attended from Washington.

In opening the conference, Frank Holland, Chairman of the Citrus Committee, Winter Haven Chamber of Commerce, attributed the tremendous progress made recently in commercial production of frozen citrus concentrates to the excellent cooperation existing among all groups involved. The conference, he said, reflected this spirit of grower - industry - research cooperation. Holland was introduced by Dr. Ralph Miller of the Plymouth Citrus Growers Association, Plymouth, Fla., who presided at the morning session of the conference. W. W. Giddings of the Polk Packing Company, presided in the afternoon.

C. W. DuBois of the Minute Maid Corporation, Plymouth, Fla., represented processors on the program with a report on the effects of storing concentrates at varying temperatures, ranging from -20 up to 75 degrees F. He said corrosion of cans was related to the storage temperature, following the same trend as clarification. No changes in cloud retention were observed at zero degrees F., and below, but at higher temperatures the rate of cloud loss increased. Flavor deterioration was observed in samples stored for six months or less at 15, 20, and 25 degrees.

Dr. F. W. Wenzel of the Florida Citrus Experiment Station, Lake Alfred, Fla., presented basic data on gelation and clarification obtained in studies conducted in cooperation with the Florida Citrus Commision during the past three seasons. Possible preventative measures considered include modified processing procedure to eliminate excessive amounts of pectin and pectin enzymes, heat treatment of the juice, the addition of chelating agents and surface active enzyme inhibitors, and storage of the finished concentrates at temperatures not exceeding zero degrees F.

Representatives from regional laboratories and field stations of the Bureau of Agricultural and Industrial Chemistry summarized recent research by the U. S. Department of Agriculture to improve processing operations as well as the quality of concentrates and other citrus products.

In a study to determine desirable temperatures and times of heating for effective pasteurization, Dr. M. K. Veldhuis said the U. S. Citrus Products Station in Winter Haven found that enzyme inactivation was reached in 1.75 seconds when temperatures were 200-210 degrees F., in 13 seconds at 195 degrees, and in 35 seconds at 190 degrees.

A. H. Brown described a direct steam-injection heater employed in high-temperature, short-time processing of fruit and vegetable juices and purees at the Western Regional Research Laboratory, Albany, Calif. Effective pasteurization is obtained with a minimum of flavor alteration, he said.

Dr. E. A. Beavens of the Fruit and Vegetable Chemistry Laboratory, Pasadena, Calif., said pilot-

plant studies suggest the possibility of restoring the volatile flavor and aroma lost during the exaporation of juice for orange concentrate by using volatile essence, cold-pressed peel oil or orange puree in place of the cut-back juice. The flavor of concentrates fortified in this manner was found to be stable at zero degrees F., he said.

R. K. Eskew described methods developed for the recovery of apple essence at the Eastern Regional Laboratory in Philadelphia. Similar procedures for the recovery of citrus essence are being studied.

In Texas the first freeze last season damaged the citrus crop seriously and the second reduced the population of citrus groves, greatly handicapping the research program at the Fruit and Vegetable Products Laboratory in Weslaco, W. C. Scott reported. He said, however, that progress has been made in the development of frozen concentrates from red and pink varieties of Texas grapefruit.

Lt. Col. H. C. Keeney of the Quartermaster Corps' Food Service Division, Washington, D. C., closed the program with a discussion of the Army's need for citrus products. He said standard menus for the armed services contain liberal quantities of orange, grapefruit, and blended juices, as well as frozen orange and tangerine concentrates, and that utilization of these products is expected to increase. He added that concentrated juices are desired which will remain stable at room temperature for periods of six months or longer.

JOHNSON PROMOTED

Armour Fertilizer- Works announces that Mr. E. C. Johnson, formerly superintendent of the Company's Jacksonville, Fla. fertilizer plant, and later superintendent of the Bartow, Fla. triple superphosphate plant, has been appointed Plant Manager of the Bartow operations. Mr. G. C. Gagel has been appointed plant superintendent at Bartow.

31 Orange County citrus growers attended a recent tour of the Citrus Experiment Station at Lake Alfred. The tour was arranged by County Agent F. E. Baetzman and conducted by Experiment Station staff members. Highlights of the field trip were demonstrations of a pneumatic pruner and a new type of harrow arrangement and discussion of concentrate spraying.

Growers And Shippers League Of Florida Annual Meeting June 14

The 28th annual meeting of the Growers and Shippers League of Florida will be held in Orlando on June 14, according to announcement by R. D. Keene, of Orlando, president of the league.

C. W. Taylor, director of the Bureau of Service of the Interstate Commerce Commission, Washington, D. C., will be featured speaker at the league's banquet which will begin at 6:30 o'clock, Thursday evening, June 14, at the Orange Court Hotel, Mr. Keene said.

Annual election of officers will follow the banquet and business meeting.

Gordon Stedman, secretary-manager of the league, said at his Orlando headquarters today that the fruit and vegetable industries of Florida would be "especially interested" in this address from Mr. Taylor, pointing out that Taylor's duties with the I.C.C. give him complete supervision over the movement of all railroad equipment, empty and loaded, in the U. S. A., including refrigerator cars."

"This is an extremely important duty and one of particular concern to Florida's fruit and vegetable industries, especially in view of the inadequate number of refrigerator cars now in railroad service," Stedman said, adding: "because of the extreme shortages of such cars recently experienced in Florida citrus and vegetable producing areas, Mr. Taylor's address will certainly be of great importance to us all in this state."

Stedman declared that Taylor was recently appointed to his position as director of the Bureau of Service, Interstate Commerce Commission," after an especially fine record with the Association of American Railroads where he served as manager of the Refrigerator Car Section, at Chicago, all during the war years, and until his going with Interstate Commerce Commission." While with the Association of American Railroads, Mr. Taylor's job was to handle the distribution of refrigerator cars under the so-called pooling arrangement.

"Because of his background of railroad experience, and particularly his splendid handling of the A. A. R's Refrigerator Car Section, Mr. Taylor is very well equipped for his position as head of the Bureau of Service of the Interstate Commerce Commission," Stedman added.

The 28th annual meeting of the league also features the report on activities from R. D. Keene, league president, and the annual report from the secretary-manager, Gordon Stedman.

In his talk Stedman will cover the general financial position of the rail carriers and their reasons for seeking authority from the I. C. C. for general increases in rates,—while at the same time they have been working with the Growers and Shippers League to reduce rail rates to retain the tonnoge they are now handling, and if possible to increase their volume of business and thereby increasing total revenues!

The Growers and Shippers League of Florida, a non-profit organization, handling transportation and traffic business for Florida's vegetable and citrus growers and shippers, is official traffic representative for the Florida Citrus Commission, Florida Canners Association and the Florida Citrus Processors Association. The league, founded 28 years ago, has a membership in all parts of the state. Many prominent Floridians, as well as the fruit-vegetable delegation, are expected at the June 14th meeting in Orlando.

New Process May Reduce Citrus Decay

A new control process developed by research workers at the Citrus Experiment Station, Lake Alfred, gives promise of greatly reducing the decay in citrus fruits. The new control solution was recently explained to packing house operations and growers by Dr. A. F. Camp, vice-director in charge of the Station, Dr. E. F. Hopkins and Dr. K. W. Loucks.

The solution is composed of Dowicide A and hexamine, supplemented with soap pand heat. It is believed that use of the new solution may reduce decay in citrus fruits by as much as 50 percent.

Original experiments with the new mold killer were conducted at the Haines City Citrus Growers Association during the 1950-51 season, utilizing some 296,225 boxes of oranges and 444,745 boxes of grapefruit. The formula includes Dowicide A, 2 percent, hexamine, 1 percent, and Palmolive soap, five-hundredths of 1 percent. The purpose of the soap is to prevent fine crystals forming in the solution, and as a better surface contact.

The fruit is dipped in this mixture for a period of two minutes at a temperature of 90 degrees Fahrenheit.

Dr. Camp explained that extensive research had been carried on previously by the station in cooperation with the Florida Citrus Commission. He said it was thought that thioreau was the answer to the decay problem, but this was discouraged by the Pure Food and Drug Administration as impractical because the chemical is readily absorbed by the human while eating fruit so treated.

Has Some Limitations

The vice director stated that a few limitations must be placed on the new miracle decay killer. He said it will control fruit decay only, while other diseases apparently are not affected. Fruit damaged in handling will still develop mold even after being treated. He added that refrigeration "is still needed" in marketing the fruit after it has been subjected to the new chemical.

Experiments made in storing oranges so treated indicates that at 60 degrees for a two-week period, no decay takes place while for the same period at 90 degrees, 65 percent of the fruit decays. For a three-week period, the loss is even greater.

The experiment station recommends that the fruit be immersed in the dowicide-hexamine dip tank after the color adding process. The tank, containing paddles and heating coils, should precede drying and waxing operations in the packing house processing line.

POLK 4-H DRESS REVUE

Winners of the recent Polk County 4-H Club Dress Revue were Jean Stack, Lorraine Kaelber, Barbara Herring, Adelle Kennedy and Ann Purvis, according to Mrs. Minnie M. Carlton, home demonstration agent at Bartow. These girls will receive trips to the Club Short Course and will participate in the State 4-H Dress Revue.

The LYONIZER

Department

COMPILED BY THE LYONS FERTILIZER CO.

Reports Of Our Field Men . . .

SOUTHWEST FLORIDA
Eaves Allison

The citrus crop in this area is holding well to date by grace of moisture which was stored up by the ample winter rains. So far there is no sign of any tree wilting or excessive dropping even though we are in need of rain in the Bradenton - Sarasota - Arcadia area at this time—May 15th. There has been considerable damage and leaf drop from six spotted mite over this section as a whole.

The vegetable deal is winding up for the season with profit for most growers. Tomato prices have held up well and a late season flurry in cuke prices has started growers picking again in some areas where there were any vines left.

Summer citrus fertilization is on in full swing and will continue through June. Well fertilized groves are never a liability.

POLK, HIGHLANDS & HARDEE COUNTIES
J. M. Sample and Frank K. Chase

Drying winds during the middle of May depleted good moisture conditions in most groves in this area. Scattered showers brought a measure of relief, but irrigation continues to be the most important problem for growers at this writing. With cool weather prevailing, six-spotted mite colonies are still apparent but little damage is being done from a new infestation standpoint.

Some new infestation of Red Scale has been noted on the new growth and Purple Scale buildups will be a problem during the summer. Many growers are planning to apply either Parathion or oil sprays for scale control beginning June 15th. The summer fertilization has been generous and will be finished about June 15th in this territory.

We are of the definite opinion that the seeded grapefruit crop will be lighter than this past season for this entire area. This does not apply to seedless grapefruit only in some groves. The tangerine crop is variable and lighter than last year. All varieties of oranges apparently indicate a good crop for next season. The possibility exists for a late bloom on these lightly cropped grapefruit and tangerine trees during the next growth period.

HILLSBOROUGH & PINELLAS COUNTIES
T. D. Watson

The condition of most groves in Hillsborough and Pinellas Counties is very good except for some signs of damage from drought. Practically all grove owners have started irrigating on the high and dry land. Grapefruit on higher land has shown signs of dropping more heaviiy than any other citrus but with adequate water will be eliminated.

The summer application of fertilizer is well under way and should have most of it out by the end of June with a few exceptions. I have noticed that some growers have started on oil sprays which is somewhat early but this was brought about by heavy infestation of six-spotted mites.

Movement of Valencias has picked up considerably this week but no one seems to be rushing the market too much which is a good sign for the price to hold fairly good through the rest of the season. Seedless varieties of grapefruit that are still on the trees have begun to drop heavily and should be gotten off as soon as possible.

Generally speaking the outlook is favorable for the present heavy crop to hold providing we have a good rain in the next few days.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

It has been very dry in this section and rain is badly needed and growers have started irrigating. In some sections the melon crops are not looking too good on account of lack of moisture.

The summer application of fertilizer is going along good, but the price of fruit is unsettled. The movement of Valencias has been slow on account of the hi-solid test. Everyone is hoping that this will straighten itself out in the near future.

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

We had a very nice rain Saturday, May 12, which was appreciated by everyone, since then have had continuous winds, therefore some of the growers who were irrigating have continued to irrigate. Lots of the growers are putting their summer application of fertilizer on. We have had the worst infestation of six-spotted mites that we have had in the last ten years, and they are still thriving, and most growers have been spraying or dusting. There is still a considerable amount of grapefruit and Valencias to be moved. Looks as though we are going to have plenty of young fruit in most all varieties for next year's crop. Groves as a whole are in good condition.

Cucumber growers are busy picking, and the yield is very satisfactory to them, and markets have improved. Also sweet corn is abundant, and moving. I think melon growers are having more difficulty at present with high winds and dry weather, though they are picking some melons.

It's a good thing that most Florida citrus growers ain't like a feller we used to know who had a big manufacturin' plant . . . for this bird would squeeze a penny harder 'n a two-year-old would cling to a stick of peppermint candy . . . result was that he was runnin' his plant with old worn out machinery and he'd fight like a treed wild cat rather than pay his help a decent wage . . . consequently his production costs were higher 'n a kite, with his equipment always havin' to be fixed and his workers not tryin' to help out the situation much.

Florida citrus growers on the other hand has long since reached the conclusion that if they want to produce big crops of high quality they've got to fertilize 'em properly . . . he's got to spray and cultivate 'em . . . and most of all that whatever he does for his groves and fields it shore doesn't pay to use inferior materials or to stint the amount of plant food he gives his crops . . . the overall cost of such procedure naturally runs higher 'n it would if the growers used cheap materials and didn't give his crops the amount of plant food needed to build strong and healthy trees and plants . . . but the per box cost of good fruit which has been produced under proper practices is invariably lower than is the case when trees are inadequately fed and improperly cared for.

Speakin' about carin' for one's groves or fields properly this present stretch of dry weather emphasizes all over agin that irrigation is a virtual necessity to most growin' operations in this state . . . irrigatin' costs money, but it also costs money . . . a heap of money . . . to have a big share of the crop which has started to mature wind up on the ground under the trees . . . there jest ain't no market for marble-sized fruit.

We're mighty glad to report that the number of growers who used Lyons Fertilizers this past year was the biggest in the history of the company, which also naturally applies to the amount of fertilizer this company sold last year . . . we git a big kick out of this state of affairs 'cause it goes to show what we've been sayin' fer years that growers can produce Maximum Crops of Finest Quality with Lyons Fertilizers.

Uncle Bill

Storage Test Of Florida Oranges 1950

PAUL L. HARDING, JAS. S. WIANT,
W. A. RADSPINNER, M. BRYAN
SUNDAY, JACOB KAUFMAN
Division of Fruit and Vegetable Crops
and Diseases

(Continued from last issue.)

Studies were conducted to determine the effect of ethylene and color-added as restorage treatments on the keeping quality of stored fruit at 30°, 32°, and 38° F., respectively. The test consisted of 4 lots of fruit of 20 boxes each as follows: (a) control—treated with neither ethylene nor color-added, (b) ethylene only, (c) color-added only, and (d) ethylene plus color-added. The ethylene treatment was for 43 hours at a temperature between 80°-85°, and the color-added solution was held at 128° F., where used. All lots of fruit passed through the soaking tank which contained Dowicide A; liquid soap was used in washing. The 4 lots were waxed with Food Machinery Company "Flavorseal" (fog wax). Precooling was for 45 hours and the test fruit was shipped with other fruit in car FGEX 57746 under refrigeration (Section 2, Rule 80). Ryan recording thermometers, located in bottom and top doorway packages, showed practically identical temperatures; namely, a fairly gradual drop from 88° F. at noon of April 26 to about 50° F. at time of loading on April 28th. During the transit period the temperature dropped slowly to 42° at the time of unloading on May 2, with a further drop of 2 degrees between time of unloading and the time the test boxes were placed in the different storage rooms on May 4.

Inspections on the fruit were made at the end of 8, 12, and 16 weeks storage, and twice during the holding period at 70° F.

The findings showed that relatively little decay or skin breakdown occurred during storage for 8 or 12 weeks at 30° or 32° or during the 3 day period at 70° F. following removal from storage. Rather high amounts of decay were present in all lots stored at 38° F. for 12 and 16 weeks. During the holding tests at 70° decay increased to such an extent as to make 38° storage impractical.

From the start to the end of the test, the fruit treated with color-added (either alone or with ethylene) had the deepest orange rind color, and the control lots the greenest. Other than that, there was no distinguishable difference in appearance, firmness, or freshness among treatments. A careful examination of the data showed that severe aging and pitting were generally more prevalent in the fruit treated with ethylene, particularly where ethylene was used in conjunction with color-added.

RESULTS AT NEW YORK, N. Y. RELATION OF COLOR-ADDED AND ETHYLENE TREATMENTS TO STORAGE BEHAVIOUR

Data on the juice characters showed a general uniformity among treatments, storage temperature, and length of the storage period. The exception was that flavor was generally rated as fair, instead of good, when storage was extended to 12 and 16 weeks.

There was likewise a general uniformity in loss in weight. The results show there was an average loss of 2.3 percent at 8 weeks; 3.2 percent at 12 weeks; and 4.0 percent at 16 weeks.

Attention should be called to a low temperature storage injury that occurred at 30° and 32° F., but was more serious with fruits stored at the lower temperature. The affected oranges were somewhat soft, flabby, and had a water-soaked appearance of the entire surface. Distribution of these affected fruits was as follows: 2 percent in 2 of the 8 boxes withdrawn after 8 weeks storage at 30° F.; none in storage lots at 32° F.; 2.5 perecnt in 5 of 8 boxes withdrawn after 12 weeks at 30° F.; 1.5 percent in 2 of 8 boxes stored at 32° F. Injured fruits were found in all 8 boxes after 16 weeks storage at 30°, with 3 percent noted at the first inspection and cumulative totals of 5 and 6 percent at second and third inspections, respectively. At 32° affected fruits were found in all 8 boxes which averaged about 2 percent, and was most evident at the time of the second inspection.

So far as could be determined the temperature in the 30° room never dropped low enough to cause freezing. At the same time it is recognized that this possibility has to be considered. The fact, however, that affected oranges were found scattered through the box, and that the condition was also observed in lots stored at 32°, as well as 30°, indicates that the water-soaked condition was a form of storage — or low-temperature breakdown, rather than freezing injury.

From an overall picture of the test it would appear that best results were secured by storage at 32°, rather than at either 30° or 38°. At 32°, the 12 week storage period was entirely successful. On the basis of condition only at time of removal, storage was successful for the 16 weeks. However, decay increased rapidly during the 3-day holding test at 70° and the results indicated that 16 weeks was too long a storage period for this fruit.

Relation of Rootstock to Storage Behavior

Tests were also conducted in New York, N. Y. to determine the storage behavior of fruits grown on rough lemon and sour orange rootstocks. The test packages consisted of 2 test lots of 20 boxes each and storage was for 8, 12, and 16 weeks at 30°, 32° and 38° F. Inspections on the fruit were made at time of removal from storage and after 3 and 7 days at 70°.

Packing house treatments were the usual ones. The fruit was washed, waxed, and polished. The test fruit was shipped to New York with other fruit in car WFEX 71076 under refrigeration (Section 2, Rule 80). During rail transit, the temperature in the car was reduced from 62° to 50°.

The results show that the rootstocks on which the oranges were grown affected total percentage of decay. It may be observed that

slightly lower amounts occurred in storage and during the 3-day holding test when the Valencias were grown on sour orange rather than rough lemon rootstock. The differences were small but were in agreement with other results presented earlier in this report.

There are other points that should be mentioned. For example, slightly less decay occurred at 32° than at 30° and as would be expected total decay increased with length of storage. Very high percentages of decay developed at 38° storage as was the case in tests made in Orlando.

There was little correlation between rootstocks and the small amount of skin breakdown that was found. Severe pitting and aging seldom exceeded 2 percent and were generally regarded as too small to have economic importance.

Comparison of Holding Temperatures Following Removal of Oranges from Storage

Storage tests were conducted at New York City to determine the rate of increase in decay in oranges held at different temperatures following storage. Twenty-eight boxes of fruit were used in the studies and 2 tests were made, one after 7 weeks storage, the other after 14 weeks, both at 32° F. The procedure after storage was as follows: (a) fruit was held continuously at 80° to 85°; (b) at 70°; (c) in a home refrigerator at 40° to 45° after previous storage for 2, 3, and 4 days at 70°. The fruit was inspected for decay at the time it was removed from 32° storage. During the holding period it was inspected daily, for the most part, for a one week period. Decayed oranges were removed at each inspection.

Comparatively little decay was found at the initial inspection (after 7 weeks' storage at 32°). The fourth day's inspection showed somewhat greater amounts of decay in those boxes of fruit which were held continuously at high temperatures (70° and 80° to 85°), and decay increased during the remainder of the 7-day holding period. There was little difference between the lots transferred to 40-45°, after 2, 3, or 4 days holding at 70°. However, much less decay was found in this fruit transferred to 40° to 45° than in those lots that were held continuously at high temperatures.

More pronounced differences were found among lots in the test conducted after 14 weeks' storage. Decay developed rapidly in the fruit that was held continuously at high temperatures (70° and 80° to 85°), after removal from storage. Considerable decay developed in 3 and 4 days at 70° before the oranges were transferred to 40° to 45°, and there was little difference between the fruit held 3 and 4 days in respect to decay development. Much less decay was found in the lot that was transferred after 2 days at 70°. This lot of fruit had a low decay count at the time of the initial inspection, and again after 2 days at 70°, suggesting fewer infected fruits at the start of the test. Thus, the lot did not appear typical of the whole.

These tests were too limited in scale to permit more than tentative conclusions.

The data do show the striking increase in decay between the third and seventh day at 70° and 80° to 85° F. They also show the advisability of using refrigeration in the store and home to prevent decay of oranges removed from cold storage. The data further suggest that if practicable it would be advantageous to reduce the marketing period (i.e. the period during which the fruit would be subjected to warm temperatures) for stored fruit to a maximum of 2 days.

COMMERCIAL STORAGE OF ELEVEN CARS OF FLORIDA GRAPEFRUIT AND ORANGES AT NEW YORK AND PROVIDENCE

As a part of the project on the storage of citrus fruits, a study was made on the storage of 8 cars of Florida oranges and 3 cars of Florida grapefruit (a total of 5,775 standard 1-3/5 bushel Bruce boxes). The carlots of fruit were shipped during April and May 1950 and storage was at either New York (Jersey City, N. J.), or Providence, Rhode Island.

The study was made through the mutual cooperation of various shippers and their sales representatives, Merchant Refrigeration Company, New York, N. Y., Merchants Cold Storage and Warehouse Company, Providence, R. I., Messers H. C. Diehl, Director of The Regriferation Research Foundation, and W. T. Pentzer and other representatives of the U. S. Department of Agriculture.

Each carlot of fruit was handled in a strictly commercial manner, and complete information was obtained as to the history of the fruit, packing-house treatment, and shipping conditions. Inspections of the fruit were made at the time the cars were unloaded and periodically during storage. Usually at each inspection 4 boxes of representative sizes were taken to the Market Pathology laboratory at New York City, where the phenodor liners were removed and discarded. The fruit was examined, decayed fruit removed, and the sound fruit repacked and placed at 70° F. for inspections after 3 and 7 days. The boxes of fruit from the Providence cars were shipped by refrigerated truck, giving overnight service to the New York laboratory.

The shippers and their sales representatives were kept informed of the condition of the stored carlots of fruits and in some instances were advised to move the fruit out of storage because of the development of pitting or decay. Otherwise, no attempt was made to influence the shipper as to length of storage.

It might be pointed out that although the present report deals with the storage of oranges the information on storage behavior of the 3 carloads of grapefruit is included since the cars were stored under the same research program. Because of pitting of the rind, storage of the grapefruit in all 3 carloads was successful for only 4 weeks. Two cars were removed after that storage period. A third was held in storage 8 weeks with the result that pitting was much more serious when these fruits were removed. The 3 cars sold

for an average of $3.32 per box.

It will be noted that the 8 carloads of oranges were stored for varying periods ranging from 5 to 12 weeks with an average of 8 weeks. Although the data are not shown in the table it may be stated that commercially important skin breakdown (pitting and aging) averaged no greater than 1 percent in each of 4 carloads of oranges at the time of removal from storage. In the other 4 cars it averaged 2 percent in car J, 3 percent in car G, 4 percent in car H, and 2 to 8 percent in car D. The amount of decay found in the various carlots of oranges ranged between 0.5 percent to 5 percent and was associated with the source of the oranges and the length of the storage period. The 8 carloads of oranges sold for an average of $5.46 per box.

TABLE 1.—Records on the Commerical Storage of 11 Cars of Florida Grapefruit and Oranges 1949-1950 Season

Shipper	Shipping Point	Kind of Fruit	Boxes	Length of Storage	Date of Sale	Average Selling Price
	Florida			Weeks	1950	Per Box
A	Clermont	Duncan Grapefruit	525	4[1]	May 17	$3.55 & $3.93
B	Clermont	Duncan Grapefruit	525	8[2]	About June 12	$3.50
C	Orlando	Marsh Grapefruit	525	4[1]	June 28	$2.57 & $3.80
D	Orlando	Valencia Oranges	525	5[2]	June 28, 29, 30	$5.35
E	Waverly	Valencia Oranges	525	6[1]	June 21	$4.47
F	Clermont	Valencia Oranges	525	9[1]	July 19	$4.78
G	Isleworth	Valencia Oranges	525	11[1]	August 3	$5.37
H	Isleworth	Valencia Oranges	525	5[2]	June 30	$6.05
I	Orlando	Valencia Oranges	525	12[1]	August 17	$5.66
J	Orlando	Valencia Oranges	525	12[2]	August 16	$6.04
K	Haines City	Valencia Oranges	525	5½[1]	About July 7	$6.00

1. Merchants Refrigerating Co., New York, N. Y. 2. Merchants Cold Storage and Warehouse Co., Providence, R. I.

Florida State Horticultural Society To Meet Oct. 30

The Florida State Horticultural Society will meet this year at West Palm Beach on October 30, continuing through November 2. Officers, directors and program committee promise that this, the sixty-fourth meeting of the Society, will be the equal of any which have gone before.

Citrus growers are looking forward with anticipation to this meeting of citrus workers in the field of scientific research. Through the years the Florida State Horticultural Society has paved the way for many outstanding accomplishments in the citrus and other horticultural interests of the state.

MECHANICAL DISPENSERS INCREASE SALES OF ORANGE JUICE

Sales of reconstituted frozen concentrated orange juice from mechanical dispensers averaged about 18 percent larger than sales from the customary jugs or pitchers, in merchandising tests conducted in selected drug stores by the Production and Marketing Administration, U. S. Department of Agriculture.

Comparisons of sales were made by PMA in six stores in Washington, D. C., and six in Richmond, Va., in a study under authority of the Research and Marketing Act. The purpose was to learn the effects of use of mechanical dispensers on the volume of sales and on sanitation, and the relative efficiency of the new and the old methods of merchandising.

It was found that the juice would keep in good condition in the mechanical dispensers for at least two days after it was reconstituted, and that the dispensers, properly cared for, assured good sanitary quality in the beverage. Fountain managers agreed that the efficiency of service was improved, and that waste of juice, especially from jug breakage, was reduced.

The researchers warned that the public must be protected against the possibility of contamination of juice that might result from careless or insanitary operation of the mechanical dispensers. To do this, the temperature of the juice in the dispensers must be kept at about 38°F. and the devices must be kept clean.

A copy of the report on the from the PMA Office of Information Services, U. S. Department of study, "Merchandising Reconstituted Frozen Concentrated Orange Juice Through the Use of Mechanical Dispensers," may be obtained

USDA URGES CONSERVATION OF BURLAP AND COTTON BAGS

Conservation and maxium re-use of burlap and cotton bags and other products made from these materials, to help offset an expected tight supply situation, is urged by the U. S. Department of Agriculture.

Classified Ads

Are your citrus trees in good condition — ready to produce smooth, high quality fruit that brings top prices? The answer is YES if they've been fed Armour's Big Crop Fertilizers regularly.

Wherever citrus grows, Armour's Big Crop Fertilizers are used with outstanding results, season after season. Growers know they can depend on Armour's to supply the right amounts of the essential plant food elements that producing trees need. Order a supply — make your next application Armour's.

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Butler Feed Co.,
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Winter Garden
Dowling Feed Store,
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Harry Goldberg, Pompano
Raymond Graham, Zolfo Springs
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